Application No.: 09/765,553

IN THE SPECIFICATION:

Please replace the paragraph beginning at page 4, line 1, with the following rewritten paragraph:

C1

--In another technique, the interfering signals are selectively nulled by beam steering. Classical beam steering, however, does not provide, without additional improvements, the required angular resolution for densely populated communications environments.--

Please replace the paragraph beginning at page 4, line 20, with the following rewritten paragraph:

C2

--These and other objectives are addressed by the spread spectrum system architecture of the present invention. In one embodiment, the system includes: (i) an antenna adapted to receive a signal that is decomposable into first and second signal segments, the first signal segment of the signal being attributable to a first source and the second signal segment of the signal being attributable to a source other than the first source; and (ii) an oblique projecting device, in communication with the antenna, for determining the first signal segment. The signal can be any structured signal, such as a spread spectrum signal, that is decomposable into at least a first signal segment and a second signal segment. A "structured signal" is a signal that has known values or is created as a combination of signals of known values.--

Please replace the paragraph beginning at page 5, line 17, with the following rewritten paragraph:

--For spread spectrum applications where noise characteristics are quantifiable, oblique projection is preferably performed utilizing the following algorithm:

$$(y^T (I-S (S^TS)^{-1}S^T) H(H^T(I-S(S^TS)^{-1}S^T)H)^{-1}H^T(I-S(S^TS)^{-1}S^T)y)/\sigma^2$$

C3

where y corresponds to a selected portion of the spread spectrum signal, H corresponds to an interference code matrix for the first signal segment (which defines a first space including the first signal), S corresponds to the interference code matrices for signals of all of the other sources (users) in the selected portion of the spread spectrum signal (which defines a second space including the signals of the other sources), ^{T} corresponds to the transpose operation and σ^2 corresponds to the variance of the magnitude of the noise in the selected portion of the spread spectrum signal. Where noise is present, a substantial portion of the noise may be generated by the receiver. As will be appreciated, the oblique projection can be done using other suitable algorithms.--

Please replace the paragraph beginning at page 6, line 13, with the following rewritten paragraph:

C4

--(b) a projection filter for determining the first CDMA signal segment, the first CDMA signal segment spanning a first signal space, the projection filter being in communication with the one or more antennas and determining the first CDMA signal segment by projecting a signal space spanned by the signal onto the first signal space. The first signal space is orthogonal to an interference space that corresponds to an interference code matrix for the second CDMA signal segment and/or second emitter.--

Please replace the paragraph beginning on page 10, line 10, with the following rewritten paragraph:

C5

--Fig. 6 depicts the three dimensional correlation surface output by the bank of projection filters in the correlating device of Fig. 1;--

Please replace the paragraph beginning on page 10, line 14, with the following rewritten paragraph:

C6

--Fig. 9 depicts a correlation surface defined by the correlation function output by the bank of projection filters in the demodulating device of Fig. 1;--

Please replace the paragraph beginning on page 11, line 12, with the following rewritten paragraph:

C7 Cont.

--An overview of the current architecture for detecting signals from an ith user in a CDMA system is illustrated in Fig. 1. The architecture employs a single antenna for receiving CDMA signals. The system includes the antenna 50 adapted to receive the spread spectrum signal and generate an output signal 54, filters 58 and 60 for filtering the in-phase ("I") and quadrature ("Q") channels to form filtered channel signals 62 and 66, a correlating device 70 for providing a hypothetical correlation function characterizing a filtered signal segment, which may be multipath signal segment(s) of a source signal (hereinafter collectively referred to as a "signal segment"), transmitted by a selected user, a first threshold detecting device 74 for generating timing information defining the temporal relationship among a plurality of peaks defined by the hypothetical correlation

function, a timing reconciliation device 78 for determining a reference time based on the timing information, a RAKE processor 82 for aligning multipath signal segments for each selected user in time and phase and outputting an aligned signal for the selected user, a demodulating device 86 for demodulating aligned signals transmitted by each selected user into correlation functions and, finally, a second threshold detecting device 90 for converting the correlation functions into digital information. As will be appreciated, a system configured for radar or GPS applications may not include some of these components, such as the filters 58 and 60, and the conversion from analog to digital may be performed either at RF or IF.--

C1 Cont.

Please replace the paragraph beginning on page 13, line 20, with the following rewritten paragraph:

--The hypothetical projection operators are generated using the algorithm:

$$(I-S(S^TS)^{-1}S^T)\ H\ (H^T(I-S(S^TS)^{-1}S^T)\ H)^{-1}H^T(I-S\ (S^TS)^{-1}S^T)$$

where H corresponds to an interference code matrix for the selected signal segment, S corresponds to the interference code matrices for all of the other signal segments in the selected filtered signal portion, I is the identity matrix, and ^{T} corresponds to the transpose operation. The variables H and S depend upon the interference codes determined by the user code generator 94. Accordingly, H and S depend, respectively, upon the transmit time for the selected signal segment, and the transmit times of all of the other signal segments in the selected filtered signal portion. Because the data is indexed by the receive time, S is also a function of the receive time.--

C2

Please replace the paragraph beginning at page 14, line 11, with the following rewritten paragraph:

C9

--Next, the bank of projection filters 102, with one filter corresponding to each trial time and/or candidate symbol (i.e., to each hypothetical projection operator), provide a set of filter outputs (i.e., hypothetical correlation functions) to be threshold detected by the first threshold detecting device 74. Each of the bank of projection filters correlates 130 a plurality of multipath signal segments for a given trial time and/or candidate symbol. The projection filters 102 extract an estimated signal segment attributable to a given user from each selected filtered signal portion while simultaneously nulling out the other signal segments from other users.--

Please replace the paragraph beginning at page 18, line 1, with the following rewritten paragraph:

C10 cont.

The first threshold detecting device 74 uses the hypothetical correlation functions for each user that are outputted by the bank of projection filters 102 to determine the temporal locations of the various multipath signal segments in the hypothetical correlation function. Due to multipath delays, each hypothetical correlation function can have multiple peaks as shown in Fig. 6. As set forth above, the various peaks in the correlation surface can be isolated using known mathematical techniques. Using techniques known in the art and the temporal location of the peaks (or timing information) output by the first threshold detecting device 74, the timing reconciliation device 78 determines a reference time for the RAKE processor 82. The reference time is based upon the receive times of the various peaks located by the first threshold detecting device 74. The reference

C10 cont'd

time is used by the RAKE processor 82 as the time to which all of the signal segments for a given user are aligned.--

Please replace the paragraph beginning at page 18, line 12, with the following rewritten paragraph:

C11

--The RAKE processor 82 based on the timing information, the peak amplitudes of the hypothetical correlation function(s) detected by the first threshold detecting device, and the filtered signals 62 and 66 scales and aligns (in time and phase) the various multipath signal segments transmitted by a given user and then sums the aligned signal segments for that user. The RAKE processor 82 can be a maximal SNR combiner.--

Please replace the paragraph beginning at page 19, line 5, with the following rewritten paragraph:

C12

Referring again to Figs. 1 and 7 (which illustrates the operation of RAKE processor 82), the RAKE processor 82 first sums 178 the outputs of the various antenna elements, shifts 182 the various sequences in the outputs by the amounts of the multipath delays between the corresponding multipath signal segments of a selected signal segment, so that all multipath signal segments are perfectly aligned. It then weights each shifted multipath signal segment by the amplitude of the correlation function corresponding to that segment and sums 186 the weighted components to produce the aligned signal $y_R(k)$. The aligned signal $y_R(k)$ is then detected 187 to form digital output 188.--

Please replace the paragraph beginning at page 19, line 9, with the following rewritten paragraph:

The demodulating device 86 correlates the "RAKED" sequence, $y_R(k)$ with the appropriate replicated segment of the coded signal in the filter bank 102 to produce the correct correlation function for detection by a second threshold detecting device 90. Referring to Figs. 1 and 8 (which illustrates the components of demodulating device 86), the demodulating device 86, like the correlating device 70 includes a user code generator 200, a projection builder 204, and a bank of projection filters 208. The projection builder 204 and bank of projection filters 208 use the equations set forth above to provide projection operators and correlation functions. Unlike the correlating device 70 which provides for a series of hypothetical projection operators and correlation functions based on the trial time, receive time, and candidate symbol for each multipath signal segment, the demodulating device 86 uses the "RAKED" sequence which has only a single aligned signal segment rather than a plurality of independent multipath signal segments. Accordingly, the demodulating device 86 is able to reliably estimate the actual transmit time for the source signal and therefore requires considerably less processing to determine a correlation function than the correlating device 70.--

C13

Please replace the paragraph beginning at page 21, line 17, with the following rewritten paragraph:

--Fig. 10 depicts a multiple antenna system according to another embodiment of the present invention. Each antenna 50a-n is connected to filters 250a-n and 254a-n, correlating device 258a-n,

C14 Cont.

C14 Cont'd.

threshold detecting device 262a-n, and a RAKE processor 266a-n. The threshold detecting devices 262a-n for all of the antennas 50a-n are connected to a common timing reconciliation device 270, which in turn is connected to all of the RAKE processors 266a-n. In this manner, all of the RAKE processing for all of the filtered signals is performed relative to a common reference time. The combined output of the RAKE processors 266a-n is provided to a common demodulating device 274 for determination of the correlation functions and summing of the signal portions received by all of the antennas that are attributable to a selected user. The system in effect "phases" the output of each antenna in order to maximize the SNR.--

Please replace the paragraph beginning at page 24, line 9, with the following rewritten paragraph:

C15

The outputs from the other RAKE processors 266a-n are combined 342 to form a combined output 343.

IN THE CLAIMS:

Please amend Claims 4, 11, 13-17, 19,29, 39-40, 42-45, and 47 as follows:

C14 Cont'd.

4. (Once Amended) The system of Claim 3, further comprising a plurality of RAKE processors corresponding with the plurality of projecting means, wherein each of the plurality of projecting means produces a respective projecting means output which is received as a RAKE processor input by each of the plurality of projecting means' corresponding RAKE processor, the respective output of each of the plurality of projecting